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(54) SYNERGISTIC INSECTICIDAL COMPOSITIONS

SYNERGISTISCHE INSEKTIZIDE ZUSAMMENSETZUNGEN

COMPOSITIONS INSECTICIDES SYNERGIQUES

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Remarks:

The file contains technical information submitted after the application was filed and not included in this specification

EP 1 198 170 B1

Description

BACKGROUND OF THE INVENTION

[0001] Insecticidal agents and compositions have been developed to control insect pests such as agrohorticultural pests, hygienic pests, or wood-eating pests and in practice have been used as a single or a mixed agent. However, economically efficient and ecologically safe insect control compositions are still being sought. Insecticidal compositions which allow for reduced effective dosage rates, increased environmental safety and lower incidence of insect resistance are highly desirable. Although the rotational application of insect control agents having different modes of action may be adopted for good pest management practice, this approach does not necessarily give satisfactory insect control. Further, even though combinations of insect control agents have been studied, a high synergistic action has not always been found. Obtaining an insecticidal composition which demonstrates no cross-resistance to existing insecticidal agents, no toxicity problems and little negative impact on the environment is extremely difficult.

[0002] Therefore, it is an object of this invention to provide a synergistic insecticidal composition which demonstrates a high controlling effect with concomittant reduced crop production cost and reduced environmental load.

[0003] It is another object of this invention to provide methods for synergistic insect control and enhanced crop protection.

SUMMARY OF THE INVENTION

[0004] The present invention provides an insecticidal composition comprising as essential active ingredients a neuronal sodium channel antagonist of formula I in combination with one or more compounds selected from the group consisting of pyrethroids, pyrethroid-type compounds, recombinant nucleopolyhedroviruses capable of expressing an insect toxin, organophosphates, carbamates, formamidines, macrocyclic lactones, amidinohydrazones, GABA (gamma-aminobutyric acid) antagonists, and acetylcholine receptor ligands in synergistically active amounts.

[0005] The present invention also provides a method for insect control which comprises contacting said insect with a synergistically effective amount of a neuronal sodium channel antagonist in combination with one or more compounds selected from the group consisting of pyrethroids, pyrethroid-type compounds, recombinant nucleopolyhedroviruses capable of expressing an insect toxin, organophosphates, carbamates, formamidines, macrocyclic lactones, amidinohydrazones, GABA antagonists and acetylcholine receptor ligands.

[0006] The present invention further provides a method for the enhanced protection of plants from infestation and attack by insects.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

[0007] "Acetylcholine receptor ligand compound" as used in this application means a compound which is capable of binding to the acetylcholine receptor site.

[0008] "Group A" as used in this application means insecticidal

1) pyrethroid compounds;
2) pyrethroid-type compounds;
3) recombinant nucleopolyhedroviruses capable of expressing an insect toxin;
4) organophosphate compounds;
5) carbamate compounds;
6) formamidine compounds;
7) macrocyclic lactone compounds;
8) amidinohydrazone compounds;
9) GABA antagonist compounds; and
10) acetylcholine receptor ligand compounds.

[0009] "Haloalkyl" as used in this application means an alkyl group C_xH_{2x+1}, having 1 to 2x+1 halogen atoms which may be the same or different. Similarly, the terms "haloalkenyl", "haloalkynyl", "haloalkoxy", "halophenyl" and the like mean mono- to perhalogen substitution wherein the halogens may be the same or different.

[0010] "Halogen" as used in this application means Cl, Br, I or F.

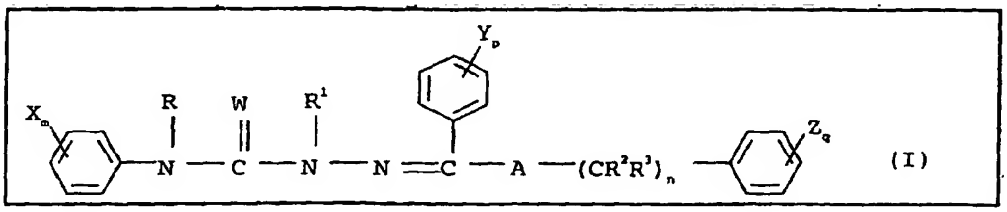
[0011] "Neuronal sodium channel antagonist" as used in this application means a compound which is capable of preventing the ability of a neuron cell to transfer sodium ions across the cell membrane. "Pyrethroid-type compounds"

as used in this application means those compounds characterized by a non-ester linked aryl-phenoxybenzyl moiety. "Synergism" as used in this application means a cooperative action encountered in a combination of two or more bioiogically active components in which the combined activity of the two or more components exceeds the sum of the activity of each component alone.

[0012] Surprisingly, it has now been found that a composition which comprises a combination of a neuronal sodium channel antagonist and a second insecticidal ingredient provides superior insect control at lower levels of the combined active agents than may be achieved when the neuronal sodium channel antagonist or the second insecticidal ingredient is applied alone.

[0013] As previously stated, the term neuronal sodium channel antagonist designates a compound which is capable of preventing the ability of a neuron cell to transfer sodium ions across the cell membrane. A neuron cell thus affected is unable to fire, resulting in paralysis, and ultimately mortality, in the target host. Descriptions of neuronal sodium channel antagonists and their mode of action may be found in Pesticide Biochemistry and Physiology, 60: 177-185 or Archives of Insect Biochemistry and Physiology, 37: 91103.

[0014] Neuronal sodium channel antagonists include compounds such as those described in U.S. 5,543,573, where hydrazinecarboxamide derivatives are disclosed; U.S. 5,708,170; U.S. 5,324,837 and U.S. 5,462,938, among other publications. The neuronal sodium channel antagonist compounds useful in the composition of this invention are those compounds having the structural formula I



wherein

A is CR^4R^5 or NR^6;

W is O or S;

X, Y and Z are each independently H;

halogen; OH; CN; NO_2; C_1-C_6-alkyl optionally substituted with one or more halogen, C_1-C_3-alkoxy, C_1-C_3-haloalkoxy, C_3-C_6-cycloalkyl, C_2-C_6-alkenyloxy or sulfonyloxy groups;

C_1-C_6-alkoxy optionally substituted with one or more halogen, C_1-C_3-alkoxy or C_3-C_6-cycloalkyl groups;

C_1-C_6-alkoxycarbonyl, C_3-C_6-cycloalkylcarbonyloxy, phenyl optionally substituted with one or more halogen, C_1-C_4-lkyl, or C_1-C_4-alkoxy groups;

aminocarbonyloxy optionally substituted with one or more C_1-C_3-alkyl groups;

C_1-C_6-alkoxycarbonyloxy; C_1-C_6-alkylsulfonyloxy;

C_2-C_6-alkenyl; or NR^7R^8;

m, p and q are each independently an integer of 1, 2, 3, 4, or 5;

n is an integer of 0, 1 or 2;

R, R^1, R^3, R^3, R^4 and R^5 are each independently H or C_1-C_4alkyl;

R^6 is H, C_1-C_6-alkyl, C_1-C_6-haloalkyl, C_1-C_6-alkoxyalkyl, C_1-C_6-alkoxy, C_1-C_6-haloalkoxy, C_2-C_6-alkenyl , C_2-C_6-alkynyl, C_1-C_6-alkylcarbonyl, C_1-C_6-alkoxycarbonyl, C_1-C_6-alkylthio, or C_1-C_6-haloalkylthio;

R^7 and R^8 are each independently H or C_1-C_6alkyl;

and the dotted line configuration

C=N represents a double bond or a single bond

(i.e. C-N or C=N); or a stereoisomer thereof.

[0015] Preferred neuronal sodium channel antagonists suitable for use in the composition of the invention are those compounds of formula I wherein the dotted line configuration C=N represents a double bond.

[0016] Particularly preferred neuronal sodium channel antagonists useful in the composition of the invention are

those compounds of formula I wherein W is O; X is trifluoromethoxy and is in the 4-position; Y is trifluoromethyl and is in the 3-position; Z is CN and is in the 4-position; A is CH_2; n is 0; m, p and q are each 1; R and R^1 are each H; and the dotted line configuration C=N represents a double bond; or a stereoisomer thereof.

[0017] The second active ingredient of the insecticidal composition of the invention includes one or more compounds selected from Group A:

1) pyrethroid compounds which are known to be insecticidally active such as cypermethrin, cyhalothrin, cyfluthrin, permethrin or the like;
2) pyrethroid-type compounds which are known to be insecticidally active such as ethofenprox, silafluofen, or the like;
3) recombinant nucleopolyhedroviruses capable of expressing an insect toxin, preferably an insect neurotoxin such as Androctonus australis insect toxin (AaIT), for example H_zNPV-AaIT;
4) organophosphate compounds which are known to be insecticidally active such as profenofos, acephate, sulprofos, malathion, diazinon, methyl parathion, terbufos, or the like;
5) carbamate compounds which are known to be insecticidally active such as methomyl, thiodicarb, fenothiocarb, or the like;
6) formamidine compounds which are known to be insecticidally active such as amitraz, chlordimeform, hydramethylnon, chlorfenamidine, or the like;
7) macrocyclic lactone compounds which are known to be insecticidally active such as spinosad, avermectin, emamectin, milbemectin, nemadectin, moxidectin or the like;
8) amidinohydrazone compounds which are known to be insecticidally active such as hydramethylnon;
9) GABA antagonist compounds which are known to be insecticidally effective such as fipronil, endosulfan, or the like;
10) acetylcholine receptor ligand compounds which are known to be insecticidally effective such as imidacloprid, acetamiprid, nitenpyram, thiamethoxam, or the like.

[0018] Descriptions of the above-listed commercially available compounds may be found in The Pesticide Manual, 11th Edition, British Crop Protection Council (1997) among other publications. Descriptions of recombinant nucleopolyhedroviruses capable of expressing an insect toxin include Treacy et al, Proceedings Beltwide Cotton Conference (1999), pp 1076-1083.

[0019] Preferred compositions of the invention are those compositions having a neuronal sodium channel antagonist compound of formula I in combination with one or more compounds selected from Group A.

[0020] More preferred compositions of the invention are those compositions having a formula I compound wherein W is O; X is trifluoromethoxy and is in the 4-position; Y is trifluoromethyl and is in the 3-position; Z is CN and is in the 4-position; A is CH_2; n is 0; m, p and q are each independently 1; R and R_1 are each independently H; and the dotted line configuration C=N represents a double bond in combination with one or more compounds selected from Group A.

[0021] Each of the compounds of formula I embody assymetric centers which may be represented in the stereoisomeric R-form or S-form. The present invention also includes the R-form, the S-form or mixtures comprising the R-form and the S-form in an arbitrary ratio.

Advantageously, the neuronal sodium-channel antagonist compound of formula I may be formulated with a second insecticidally effective ingredient and optionally other customary formulation adjuvants. Said formulation may be dispersed in a solid or liquid diluent for application to the insect, its food supply, breeding ground or habitat as a dilute spray or as a solid dust or dust concentrate.

[0022] The active ingredients of the inventive composition may also be formulated separately as a wettable powder, emulsifiable concentrate, aqueous or liquid flowable, suspension concentrate or any one of the conventional formulations used for insect control agents and tank-mixed in the field with water or other inexpensive liquid for application as a liquid spray mixture.

[0023] Advantageously, the composition of the invention may be formulated as a bait composition comprising a synergistically effective amount of a combination of a neuronal sodium channel antagonist (I) plus one or more compounds selected from Group A and a solid or liquid edible nutritive substance. A preferred bait composition may contain by weight about 0.01% to 20% active ingredients, preferably a neuronal sodium channel antagonist (I) in combination with hydramethylnon.

[0024] In actual practice, the composition of the invention may be applied to the plant foliage or plant stem or to the insect habitat or to the locus of a hygienic pest as a dilute spray prepared from any of the above-said formulations. The ratio of the essential active ingredients of the composition of the invention is about 1 weight part of a neuronal sodium channel antagonist to about 0.01-100 weight parts of one or more compounds selected from Group A.

[0025] The compositions of the invention are superior insecticidal compositions and are especially useful for the control of agrohorticultural pests, hygienic pests or wood-eating pests. Said compositions are highly effective for the

protection of growing and harvested plants including: leguminous crops such as soybeans, snap beans, peas, wax beans and the like as well as cotton, forage crops, cole crops, leafy vegetables, tobacco, hops, tomatoes, potatoes, flowering ornamentals such as chrysanthemums, vine crops such as grapes, squash, pumpkin or melon and fruit trees such as cherry, peach, apple or citrus, from the ravages of insects.

[0026] The insecticidal composition of the invention is found to be highly active against a wide variety of lepidopteran and coleopteran insects such as *Helicoverpa zea* (cotton bollworm), *Heliothis virescens* (tobacco budworm), *Leptinotarsa* decemlineata (Colorado potato beetle), *Diabrotica spp.* (corn rootworm) and the like.

[0027] Beneficially, the composition of the invention may be useful for the prevention and control of hygienic or public health pests such as: Diptera, e.g. houseflies, mosquitoes, or the like; Hymenoptera, e.g. ants, parasitic wasps, wasps or the like;.Blattaria, e.g. cockroaches; or the like.

[0028] Further, the compositions of the invention may be particularly useful for the prevention and control of wood-eating insects such as termites (Isoptera), carpenter ants (Hymenoptera), wood-destroying beetles (Coleoptera) or the like.

[0029] These and other advantages of the invention may become more apparent from the examples set forth herein below. These examples are provided as illustrations of the invention.

EXAMPLE 1

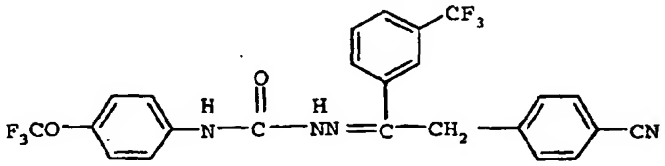
Evaluation of the Synergistic Insecticidal Effect of a Combination of a Neuronal Sodium Channel Antagonist Plus a Second Insecticide

[0030] In this evaluation, *Heliothis zea* (cotton bollworm), *Heliothis virescens* (tobacco budworm) and pyrethroid-resistant *Heliothis virescens* larvae used are obtained from laboratory colonies. Pyrethroid-resistant H. virescens are derived from the PEG-strain [Campannola & Plapp, Proceedings of Beltwide Cotton Conference (1988)].

[0031] Cotton leaves are immersed in 1:1 v/v, acetone/water solutions of test compound, or solutions of a combination of test compounds for a period of about 3 seconds. Following immersion, leaves are allowed to air-dry for 2-3 hours. Plastic bioassay trays containing multiple open-faced wells (4.0 x 4.0 x 2.5 cm) are used as the test arenas. Cut portions of a treated leaf, a moistened cotton dental wick and a single third-instar larva are placed into each well, covered with an adhesive vented clear plastic sheet and held under constant fluorescent light at about 27°C for a predetermined period of time. Larval mortality/morbidity is evaluated at 5 days after treatment. All treatments are replicated 4-5 fold in a randomized complete block design with 16-32 larvae per treatment. Using conventional log-probit analysis, the LCso of each treatment is determined.

[0032] Using the above protocol, a neuronal sodium channel antagonist (Compound A) may be evaluated alone at dose rates of 0.1 ppm, 1.0 ppm and 10.0 ppm and in combination with 1.0 ppm of a second insecticidal compound. Treatments which may be used are shown in Table I.

[0033] As neural sodium channel antagonist the compound of formula Ia (compound A) was used.



(Ia)

Table I

Second	Dose		Compound A		
Active	Rate		Dose	Rate	
Compound	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
cypermethrin	0	0	0.1	1.0	10.0
	1.0	0	0.1	1.0	10.0

Table I (continued)

Second Active Compound	Dose Rate (ppm)	(ppm)	Compound A Dose (ppm)	Rate (ppm)	(ppm)
amitraz	0	0	0.1	1.0	10.0
	1.0	0	0.1	1.0	10.0
fipronil	0	0	0.1	1.0	10.0
	1.0	0	0.1	1.0	10.0
acetamiprid	0	0	0.1	1.0	10.0
	1.0	0	0.1	1.0	10.0
spinosad	0	0	0.1	1.0	10.0
	1.0.	0	0.1	1.0	10.0
thiodicarb	0	0	0.1	1.0	10.0
	1.0	0	0.1	1.0	10.0

EXAMPLE 2

Evaluation of the Synergistic Insecticidal Effect Of a Combination Of A Neuronal Sodium Channel Antagonist Plus an Amidinohydrazone

[0034] In this evaluation, adult male German cockroaches (Blattella germanica) are used. For each test, a 4.0 g portion of ground Purina Dog Chow (Hi-Pro Glo®) is treated with an acetone solution of test compound alone or in combination with a second test compound. After treatment, the acetone is evaporated and the treated dog chow is placed in a 3/4 oz plastic cup which is placed in a harborage made of folded sheets of blotter paper placed in a plastic box (16" L x 11" W x 6" H) . The plastic box (test arena) is also fitted with a 1 oz narrow mouth bottle with 2 dental wicks inserted at the mouth. A control box is prepared in the same manner using ground dog chow which has been treated with reagent grade acetone. Each treatment is replicated three times. Into each test arena are placed 20 healthy adult male cockroaches which have been reared in an insectary. The test arenas are then stored at 76°F and mortality is determined daily by visual examination. The data obtained are shown in Table II.

Table II

			% Mortality				
Test	% Active		Days	After	Treatment		
Compound	Ingredient	3	4	5	6 7 8		
A	0.05	0	0	0	0	0	0
A	0.10	1.7	11.7	11.7	11.7	18.3	18.3
A	0.50	5.0	5.0	5.0	5.0	5.0	5.0
B[1]	1.00	0	5.0	28.3	71.7	90.0	93.3
A+B	0.05+1.0	0	20.0	41.7	81.7	95.0	98.3
A+B	0.10+1.0	0	21.7	51.7	88.3	95.0	95.0
A+B	0.50+1.0	16.7	58.3	80.0	95.0	98.3	100.0
Control	0	0	1.7	3.3	3.3	3.3	5.0

[1]Compound B = hydramethylnon

[0035] As can be seen from the data shown in Table II, combinations of a neuronal sodium channel antagonist plus an amidinohydrazone insecticide demonstrate synergistic insect control.

EXAMPLE 3

Evaluation of the Synergistic Insecticidal Effect Of a Combination Of A Neuronal Sodium Channel Antagonist Plus A Recombinant Nucleopolvhedrovirus Capable of Expressing An Insect Toxin

[0036] In this evaluation, Helicoverpa zea (cotton bollworm) larvae are obtained from a laboratory colony. Test compounds are dissolved in 1:1 v/v acetone/water. Plastic bioassay trays (C-D International, Pitman, NJ) are used as test arenas. Each tray contains 32 openfaced wells, 4.0 x 4.0 x 2.5 cm. A portion (5 ml) of a wheat germ-soybean flour-based artificial diet (Southland Products, Lake village, AR) is poured into each well. After the diet hardened, 0.4 ml of test solution is pipetted onto the diet surface in each well. Test solutions are evenly spread over surfaces of diet by picking up the tray and gently tilting it from side to side. Trays are then held in a vented area for about 2 h, until water is no longer pooled an diet surfaces. A single 4-day-old H. zea larva is then placed an the surface of diet in each well. After larval infestation, each well is covered with an adhesive, vented, clear plastic sheet.

[0037] All test arenas are held under constant fluorescent light and a temperature of about 27°C for duration of the assay. Larval mortality is determined at 2, 3, 4 and 7 days after treatment. A larva was considered to be dead if it exhibited little to no movement, even after being shaken in the diet tray. A total of 32 insects were tested for each treatment.

[0038] The data obtained are shown in Table III.

Table III

			% Mortality		
Test	Conc. of % Active		Days After Treatment		
Test Compound	Ingredient	2	3	4	7
A	0.1 ppm	43.8	46.9	53.1	53.1
B[1]	1000 OB[2]/ml	0.0	9.4	18.8	40.6
B	500 OB[2]/ml	0.0	9.4	18.8	40.6
B	100 OB[2]/ml	3.1	3.1	3.1	15.6
A+B	0.1+1000	87.5	90.6	93.8	96.9
A+B	0.1+500	75.0	78.1	84.4	87.5
A+B	0.1+100	62.5	75.0	75.0	78.1
Control	0	3.1	3.1	3.1	3.1

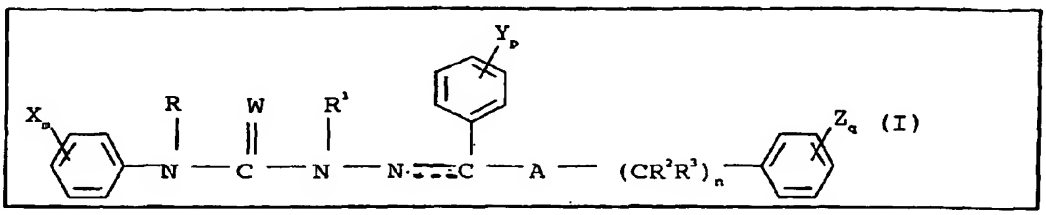
[1]Compound B = HzNPV-AaIT, *Helicoverpa zea* Nucleopolyhedrovirus which expresses *Androctonus australis* insect toxin

[2]OB = viral occlusion bodies

[0039] As can be seen from the data shown in Table III, combinations of a neuronal sodium channel antagonist plus a recombinant nucleopolyhedrovirus which is capable of expressing an insect toxin demonstrate synergistic insect control.

Claims

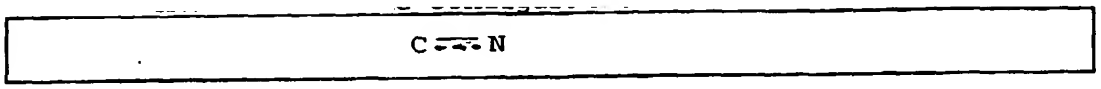
1. An insecticidal composition comprising a neuronal sodium channel antagonist of formula I:



wherein

A	is CR^4R^5 or NR^6;
W	ist O or S;
X, Y and Z	are each independently H;halogen; OH; CN; NO_2; C_1-C_6-alkyl unsubstituted or substituted with one or more halogen, C_1-C_3-alkoxy, C_1-C_3-haloalkoxy, C_3-C_6-cycloalkyl, C_2-C_6-alkenyloxy or sulfonyloxy groups; C_1-C_6-alkoxy unsubstituted or substituted with one or more halogen C_1-C_3-alkoxy or C_3-C_6-cycloalkyl groups; C_1-C_6-alkoxycarbonyl, C_3-C_6-cycloalkylcarbonyloxy, phenyl unsubstituted or substituted with one or more halogen, C_1-C_4-alkyl or C_1-C_4-alkoxy groups; aminocarbonyloxy unsubstituted or substituted with one or more C_1-C_3-alkyl groups; C_1-C_6-alkoxycarbonyloxy; C_1-C_6-alkylsulfonyloxy; C_2-C_6-alkenyl; or NR^7R^8;
m, p and q	are each independently an integer of 1, 2, 3, 4 or 5;
n	is an integer of 0, 1 or 2;
R, R^1, R^2, R^3, R^4 and R^5	are each independently H or C_1-C_4-alkyl;
R^6	is H, C_1-C_6-alkyl, C_1-C_6-haloalkyl, C_1-C_6-alkoxyalkyl, C_1-C_6-alkoxy, C_1-C_6-haloalkoxy, C_2-C_6-alkenyl, C_2-C_6-alkynyl , C_1-C_6-alkylcarbonyl, C_1-C_6-alkoxycarbonyl, C_1-C_6-alkylthio, or C_1-C_6-haloalkylthio;
R^7 and R^8	are each independently H or C_1-C_6-alkyl;

and the dotted line configuration



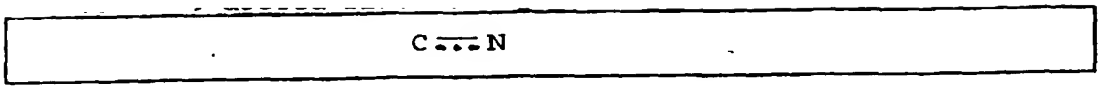
represents a double bond or a single bond; or a stereoisomer thereof,
and one or more compounds selected from Group A:

1) pyrethroid compounds;
2) pyrethroid-type compounds;
3) recombinant nucleopolyhedroviruses capable of expressing an insect neurotoxin;
4) organophosphate compounds;
5) carbamate compounds;
6) formamidine compounds;
7) macrocyclic lactone compounds;
8) amidinohydrazone compounds;
9) GABA antagonist compounds;
10) acetylcholine receptor ligand compounds
11)

in synergistically active amounts.

2. The composition according to claim 1 wherein in formula I,
W is O;
X is 4-trifluoromethoxy;
Y is 3-trifluoromethyl;
Z is 4-CN;
A is CH_2;
n is O;

m, p and q are each 1;
R and R^1 are each H;
and the dotted line configuration



represents a double bond.

3. The composition according to claim 2 wherein the one or more compounds selected from Group A are cypermethrin, cyhalomethrin, cyfluthrin, permethrin, ethofenprox, silafluofen, fipronil, endosulfon, imidacloprid, acetamiprid, nitenpyram, thiamethoxam, profenofos, acephate, sulprofos, malathion, diazinon, methyl parathion, terbufos, methonyl, thiodicarb, fenothiocarb, amitraz, chlordimeform, chlorfenamidine, avermectin, emamectin, milbemectin, nemadectin or moxidectin.

4. The composition according to claim 2 wherein the one or more compounds selected from Group A is hydramethylnon.

5. A bait composition containing by weight 0,01 % to 20 % of a neuronal sodium channel antagonist of formula I as defined in claim 1 in combination with hydramethylnon.

6. The composition according to claims 1 to 4 wherein the ratio of the active ingredients is 1 weight part of a neuronal sodium channel antagonist of formula I as defined in claim 1 to 0,01 to 100 weight parts of one or more compounds of group A as defined in claim 1.

7. A method for insect control which comprises contacting said insect with a composition according to claims 1 to 4.

8. A method for protecting a plant from infestation and attack by insects which comprises applying to the foliage or stem of said plant a synergistically effective amount of a composition according to claims 1 to 4.

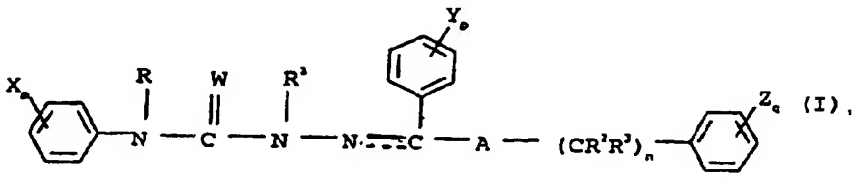
9. Use of compositions according to claims 1 to 6 for combating insects of the orders Lepidoptera and Coleoptera.

10. Use of compositions according to claims 1 to 6 for the control of hygienic or public health pests selected from the group Diptera, Hymenoptera and Blattaria.

11. Use of compositions according to claims 1 to 6 for the control of wood-eating insects selected from the group Hymenoptera, Isoptera and Coleoptera.

Patentansprüche

1. Insektizide Zusammenfassung, die einen Neuronen-Natriumkanalantagonisten der Formel I

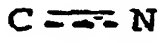


in der

A CR^4R^5 oder NR^6 bedeutet;

W	O oder S bedeutet;
X, Y und Z	jeweils unabhängig H; Halogen; OH; CN; NO_2; C_1-C_6-Alkyl, das unsubstituiert oder durch eine oder mehrere Halogen-, C_1-C_3-Alkoxy-, C_1-C_3-Halogenalkoxy-, C_3-C_6-Cycloalkyl-, C_2-C_6-Alkenyloxy- oder Sulfonyloxygruppen substituiert ist;
	C_1-C_6-Alkoxy, das unsubstituiert oder durch eine oder mehrere Halogen-, C_1-C_3-Alkoxy- oder C_3-C_6-Cycloalkylgruppen substituiert ist; C_1-C_6-Alkoxycarbonyl , C_3-C_6-Cycloalkylcarbonyloxy, Phenyl, die unsubstituiert oder durch eine oder mehrere Halogen-, C_1-C_4-Alkyl- oder C_1-C_4-Alkoxygruppen substituiert sind;
	Aminocarbonyloxy, das unsubstituiert oder durch eine oder mehrere C_1-C_3-Alkylgruppen substituiert ist;
	C_1-C_6-Alkoxycarbonyloxy; C_1-C_6-Alkylsulfonyloxy, C_2-C_6-Alkenyl; oder NR^7R^8 bedeuten;
m, p und q	jeweils unabhängig eine ganze Zahl 1, 2, 3, 4 oder 5 bedeuten;
n	eine ganze Zahl 0, 1 oder 2 bedeutet;
R, R^1, R^2, R^3 , R^4 und R^5	jeweils unabhängig H oder C_1-C_4-Alkyl bedeuten;
R^6	H, C_1-C_6-Alkyl, C_1-C_6-Halogenalkyl, C_1-C_6-Alkoxyalkyl, C_1-C_6- Alkoxy, C_1-C_6-Halogenalkoxy, C_2-C_6-Alkenyl ,
	C_2-C_6-Alkinyl, C_1-C_6-Alkylcarbonyl , C_1-C_6-Alkoxycarbonyl, C_1-C_6-Alkylthio oder C_1-C_6-Halogenalkylthio bedeutet;
R^7 und R^8	jeweils unabhängig H oder C_1-C_6-Alkyl bedeuten;

und die Konfiguration mit der gebrochenen Linie

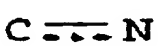


eine Doppelbindung oder Einfachbindung bedeutet;
oder ein Stereoisomer davon;
sowie eine oder mehrere Verbindungen aus der Gruppe A:

1) Pyrethroidverbindungen;
2) pyrethroidartige Verbindungen;
3) rekombinante Kernpolyederviren, die ein Insektenneurotoxin exprimieren können;
4) phosphororganische Verbindungen;
5) Carbamatverbindungen;
6) Formamidinverbindungen;
7) Makrolidverbindungen;
8) Amidinhydrazonverbindungen;
9) GABA-Antagonisten-Verbindungen;
10) Acetylcholinrezeptorliganden-Verbindungen;

in synergistischen Mengen umfaßt.

2. Zusammensetzung nach Anspruch 1, wobei in Formel I
W O bedeutet;
X 4-Trifluormethoxy bedeutet;
Y 3-Trifluormethyl bedeutet;
Z 4-CN bedeutet;
A CH_2 bedeutet;
n 0 bedeutet;
m, p und q jeweils 1 bedeuten;
R und R^1 jeweils H bedeuten;
und die Konfiguration mit der gebrochenen Linie



eine Doppelbindung bedeutet.

3. Zusammensetzung nach Anspruch 2, wobei es sich bei der einen bzw. bei den mehreren Verbindungen aus der Gruppe A um Cypermethrin, Cyhalomethrin, Cyfluthrin, Permethrin, Ethofenprox, Silafluofen, Fipronil, Endosulfon, Imidacloprid, Acetamiprid, Nitenpyram, Thiamethoxam, Profenofos, Acephate, Sulprofos, Malathion, Diazinon, Methylparathion, Terbufos, Methonyl, Thiodicarb, Fenothiocarb, Amitraz, Chlordimeform, Chlorfenamidin, Avermectin, Emamectin, Milbemectin, Nemadectin oder Moxidectin.

4. Zusammensetzung nach Anspruch 2, wobei es sich bei der einen bzw. den mehreren Verbindungen aus der Gruppe A um Hydramethylnon handelt.

5. Köderzusammensetzung, die 0,01 Gew.-% bis 20 Gew.-% eines Neuronen-Natriumkanalantagonisten der Formel I nach Anspruch 1 in Kombination mit Hydramethylnon enthält.

6. Zusammensetzung nach den Ansprüchen 1 bis 4, wobei das Verhältnis der Wirkstoffe 1 Gewichtsteil eines Neuronen-Natriumkanalantagonisten der Formel I nach Anspruch 1 zu 0,01 bis 100 Gewichtsteilen von einer oder mehreren Verbindung(en) der in Anspruch 1 definierten Gruppe A beträgt.

7. Verfahren zur Bekämpfung von Insekten, **dadurch gekennzeichnet, daß** man das Insekt mit einer Zusammensetzung nach den Ansprüchen 1 bis 4 in Kontakt bringt.

8. Verfahren zum Schützen einer Pflanze gegen Befall mit bzw. Angriff von Insekten, **dadurch gekennzeichnet, daß** man eine synergistisch wirksame Menge einer Zusammensetzung nach den Ansprüchen 1 bis 4 auf das Blattwerk oder den Stängel der Pflanze ausbringt.

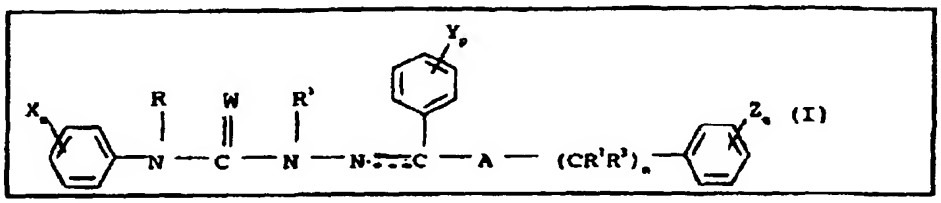
9. Verwendung von Zusammensetzungen nach den Ansprüchen 1 bis 6 zur Bekämpfung von Insekten der Ordnungen Lepidoptera und Coleoptera.

10. Verwendung von Zusammensetzungen nach den Ansprüchen 1 bis 6 für die Kontrolle von Hygieneschädlingen oder Volksgesundheitsschädlingen aus der Gruppe Diptera, Hymenoptera und Blattaria.

11. Verwendung von Zusammensetzungen nach den Ansprüchen 1 bis 6 für die Kontrolle von holzverzehrenden Insekten aus der Gruppe Hymenoptera, Isoptera und Coleoptera.

Revendications

1. Composition insecticide comprenant un antagoniste de canal sodique neuronal de formule I :

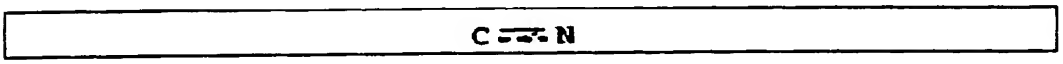


dans laquelle

A	représente CR^4R^5 ou NR^6,
W	représente O ou S,
X, Y et Z	représentent chacun indépendamment H, de l'halogène, OH, CN, NO_2, un radical alkyle en C_1-C_6 non substitué ou substitué par un ou plusieurs halogènes, des groupes alcoxy en C_1-C_3, halogénoalcoxy en C_1-C_3, cycloalkyle en C_3-C_6, alcényloxy en C_2-C_6 ou sulfonyloxy, un radical alcoxy en C_1-C_6 non substitué ou substitué par un ou plusieurs halogènes,

	des groupes alcoxy en C_1-C_3 ou cycloalkyle en C_3-C_6, un radical alcoxycarbonyle en C_1-C_6, cycloalkylcarbonyloxy en C_3-C_6, phényle non substitué ou susbtitué par un ou plusieurs halogènes, groupes alkyle en C_1-C_4 ou alcoxy en C_1-C_4, un radical aminocarbonyloxy non substitué ou substitué par un ou plusieurs groupes alkyle en C_1-C_3, un radical alcoxycarbonyloxy en C_1-C_6, alkylsulfonyloxy en C_1-C_6, alcényle en C_2-C_6, ou NR^7R^8,
m, p et q	sont chacun indépendamment un nombre entier parmi 1, 2, 3, 4 ou 5,
n	est un nombre entier parmi 0, 1 ou 2,
R,R^1, R^2, R^3, R^4 et R^5	représentent chacun indépendamment H ou un groupe alkyle en C_1-C_4,
R^6	représente H, un groupe alkyle en C_1-C_6, halogénoalkyle en C_1-C_6, alcoxyalkyle en C_1-C_6, alcoxy en C_1-C_6, halogénoalcoxy en C_1-C_6, alcényle en C_2-C_6, alcynyle en C_2-C_6, alkylcarbonyle en C_1-C_6, alcoxycarbonyle en C_1-C_6, alkylthio en C_1-C_6, ou halogénoalkylthio en C_1-C_6,
R^7 et R^8	représentent chacun indépendamment H ou un groupe alkyle en C_1-C_6,

et la configuration à ligne pointillée

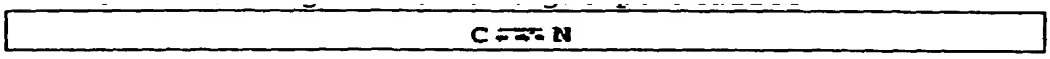


représente une double liaison ou une simple liaison, ou un stéréoisomère de celui-ci,
et un ou plusieurs composés choisis parmi le groupe A :

1) composés de pyréthroïde,
2) composés de type pyréthroïde,
3) nucléopolyhédrovirus recombinants, capables d'exprimer une neurotoxine d'insecte,
4) composés d'organophosphate,
5) Composés de carbamate,
6) Composés de formamidine,
7) composés de lactone macrocyclique,
8) composés d'amidinohydrazone,
9) composés antagonistes de GABA,
10) composés de ligand récepteur d'acétylcholine,
11)

en des quantités actives du point de vue synergique.

2. Composition suivant la revendication 1, dans laquelle, dans la formule I,
W est O,
X est du 4-trifluorométhoxy,
Y est du 3-trifluorométhyle,
Z est du 4-CN,
A est du CH_2,
n vaut 0,
m, p et q valent chacun 1,
R et R^1 sont chacun H,
et la configuration à ligne pointillée



représente une double liaison.

3. Composition suivant la revendication 2, dans laquelle les un ou plusieurs composés choisis parmi le groupe A sont du cyperméthrin, du cyhalométhrin, du cyfluthrin, du perméthrin, de l'éthofenprox, du silafluofen, du fipronil, de l'endosulfone, de l'imidacloprid, de l'acétamiprid, du nitenpyram, du thiaméthoxam, du profénofos, de l'acéphate, du sulprofos, du malathion, du diazinon, du méthyl parathion, du terbufos, du méthonyl, du thiodicarb, du fénothiocarb, de l'amitraz, du chlordiméform, de la chlorfénamidine, de l'avermectin, de l'émamectin, du milbémectin, du némadectin ou du moxidectin.

4. Composition suivant la revendication 2, dans laquelle les un ou plusieurs composés choisis parmi le groupe A sont de l'hydraméthylnone.

5. Composition d'attraction contenant 0,01 % à 20 % en poids d'un antagoniste de canal sodique neuronal de la formule I, tel que défini dans la revendication 1, en combinaison avec de l'hydra-méthylnone.

6. Composition suivant les revendications 1 à 4, dans laquelle le rapport entre les composants actifs est de 1 partie en poids d'antagoniste de canal sodique neuronal de formule I, comme défini dans la revendication 1, pour 0,01 à 100 parties en poids d'un ou plusieurs composés du groupe A, tel que défini dans la revendication 1.

7. Procédé de contrôle des insectes qui comprend une mise en contact dudit insecte avec une composition suivant les revendications 1 à 4.

8. Procédé de protection d'une plante vis-à-vis d'une infestation et d'une attaque par des insectes, qui comprend une application sur le feuillage ou la tige de ladite plante d'une quantité efficace du point de vue synergique d'une composition suivant les revendications 1 à 4.

9. Utilisation de compositions suivant les revendications 1 à 6, pour combattre des insectes des ordres des lépidoptères et des coléoptères.

10. Utilisation de compositions suivant les revendications 1 à 6, pour le contrôle d'insectes nuisibles à l'hygiène ou la santé publique choisis parmi le groupe des diptères, des hyménoptères et des Blattaria.

11. Utilisation de compositions suivant les revendications 1 à 6 pour le contrôle des insectes xylophages choisis parmi le groupe des hyménoptères, des isoptères et des coléoptères.